



## Findings

## Major Findings

1. **Groundwater provides about 30% of the State's water supply in an average year, yet in many basins the amount of groundwater extracted annually is not accurately known.**
  - In some regions, groundwater provides 60% or more of the supply during dry years.
  - Many small- to moderate-sized towns and cities are entirely dependent on groundwater for drinking water supplies.
  - 40% to 50% of Californians rely on groundwater for part of their water supply.
  - In many basins, groundwater use is indirectly estimated by assuming crop evapotranspiration demands and surveying the acreage of each crop type.
2. **Opportunities for local agencies to manage their groundwater resources have increased significantly since the passage of Assembly Bill 3030 in 1992. (Water Code § 10750 et seq.). In the past several years more agencies have developed management programs to facilitate conjunctive use, determine the extent of the resource, and protect water quality.**
  - The act provides the authority for many local agencies to manage groundwater.
  - The act has resulted in more than 200 local agencies adopting groundwater management plans to date.
  - The act encourages regional cooperation in basins and allows private water purveyors to participate in groundwater management through memoranda of understanding with public agencies.
  - Many local agencies are recognizing their responsibility and authority to better manage groundwater resources.
3. **Agencies in some areas have not yet developed groundwater management plans.**
  - Concerns about cooperative management, governance, and potential liabilities have kept some agencies from developing management plans.
  - Development of management programs to maintain a sustainable groundwater supply for local use has not been accomplished throughout the State.
4. **A comprehensive assessment of overdraft in the State's groundwater basins has not been conducted since Bulletin 118-80, but it is estimated that overdraft is between 1 million and 2 million acre-feet annually.**
  - Historical overdraft in many basins is evident in hydrographs that show a steady decline in groundwater levels for a number of years.
  - Other basins may be subject to overdraft in the future if current water management practices are continued.
  - Overdraft can result in increased water production costs, land subsidence, water quality impairment, and environmental degradation.
  - Few basins have detailed water budgets by which to estimate overdraft.
  - While the most extensively developed basins tend to have information, many basins have insufficient data for effective management or the data have not been evaluated.
  - The extent and impacts of overdraft must be fully evaluated to determine whether groundwater will provide a sustainable water supply.
  - Modern computer hardware and software enable rapid manipulation of data to determine basin conditions such as groundwater storage changes or groundwater extraction, but a lack of essential data limits the ability to make such calculations.
  - Adequate statewide land use data for making groundwater extraction estimates are not available in electronic format.

5. **Surface water and groundwater are connected and can be effectively managed as integrated resources.**
  - Groundwater originates as surface water.
  - Groundwater extraction can affect flow in streams.
  - Changes in surface water flow can affect groundwater levels.
  - Legal systems for surface water and groundwater rights can make coordinated management complex.
6. **Groundwater quality and groundwater quantity are interdependent and are increasingly being considered in an integrated manner.**
  - Groundwater quantity and groundwater quality are inseparable.
  - Groundwater in some aquifers may not be usable because of contamination with chemicals, either from natural or human sources.
  - Unmanaged groundwater extraction may cause migration of poor quality water.
  - Monitoring and evaluating groundwater quality provides managers with the necessary data to make sound decisions regarding storage of water in the groundwater basin.
  - State agencies conduct several legislatively mandated programs to monitor different aspects of groundwater quality.
  - California Department of Water Resources (DWR) monitors general groundwater quality in many basins throughout the State for regional evaluation.
7. **Land use decisions affecting recharge areas can reduce the amount of groundwater in storage and degrade the quality of that groundwater.**
  - In many basins, little is known about the location of recharge areas and their effectiveness.
  - Protection and preservation of recharge areas are seldom considered in land use decisions.
  - If recharge areas are altered by paving, channel lining, or other land use changes, available groundwater will be reduced.
  - Potentially contaminating activities can degrade the quality of groundwater and require wellhead treatment or aquifer remediation before use.
  - There is no coordinated effort to inform the public that recharge areas should be protected against contamination and preserved so that they function effectively.

### **Additional Important Findings**

8. **Funding to assist local groundwater management has recently been available in unprecedented amounts.**
  - Proposition 13 (Water Code, § 79000 et seq.) authorized \$230 million in loans and grants for local groundwater programs and projects, almost all of which has been allocated.
  - The Local Groundwater Management Assistance Act of 2000 (Water Code, § 10795) has resulted in more than \$15 million in grants to local agencies in fiscal years 2001, 2002, and 2003.
  - Proposition 50 (Water Code, § 79500 et seq) will provide funding for many aspects of water management, including groundwater management and groundwater recharge projects.
  - Funding for the California Bay-Delta program has provided technical and facilitation assistance to numerous local groundwater planning efforts.

9. **Local governments are increasingly involved in groundwater management.**
  - Twenty-four of the 27 existing county groundwater management ordinances have been adopted since 1990.
  - Most ordinances require the proponents of groundwater export to demonstrate that a proposed project will not cause subsidence, degrade groundwater quality, or deplete the water supply before the county will issue an export permit.
  - While the ordinances generally require a permit for export of groundwater, most do not require a comprehensive groundwater management plan designed to ensure a sustainable water resource for local use.
  - Some local governments are coordinating closely with local water agencies that have adopted groundwater management plans.
  - Many local governments are monitoring and conducting studies in an effort to better understand groundwater resources.
10. **Despite the increased groundwater management opportunities and activities, the extent of local efforts is not well known.**
  - There is no general requirement that groundwater management plans be submitted to DWR, so the number of adopted plans and status of groundwater management throughout the State are not currently known.
  - There are no requirements for evaluating the effectiveness of adopted plans, other than during grant proposal review.
  - No agency is responsible for tracking implementation of adopted plans.
  - Unlike urban water management plans, groundwater management plans are not required to be submitted to DWR, making the information unavailable for preparing the California Water Plan.
11. **Despite the fact that several agencies often overlies each groundwater basin, there are few mechanisms in place to support and encourage agencies to manage the basin cooperatively.**
  - Some local agencies have recognized the benefits of initiating basinwide and regional planning for groundwater management and have recorded many successes.
  - Regional cooperation and coordination depends on the ability of local agencies to fund such efforts.
  - There is no specific State or federal program to fund and support coordination efforts that would benefit all water users in a region and statewide.
12. **The State Legislature has recognized the need to consider water supplies as part of the local land use planning process.**
  - Three bills—Senate Bill 221<sup>1</sup>, SB 610<sup>2</sup>, and AB 901<sup>3</sup>—were enacted in 2001 to improve the assessment of water supplies. The new laws require the verification of sufficient water supply as a condition for approving certain developments and compel urban water suppliers to provide more information on the reliability of groundwater as an element of supply.
  - The Government Code does not specifically require local governments to include a water resources element in their general plans.

---

<sup>1</sup> Business and Professions Code Section 11010, Government Code Sections 65867.5, 66455.3, and 66473.7.

<sup>2</sup> Public Resources Code Section 21151.9, Water Code Sections 10631, 10656, 10657, 10910-10912, 10915.

<sup>3</sup> Water Code Sections 10610.2, 10631, 10634.

13. **The need to monitor groundwater quality and contamination of groundwater continues to grow.**
  - As opportunities for developing additional surface water supplies become more limited, subsequent growth will increasingly rely on groundwater.
  - Human activities are likely the cause of more than half the exceedances of maximum contaminant levels in public water supply wells.
  - New contaminants are being regulated and standards are becoming more stringent for others, requiring increased monitoring and better management of water quality.
14. **Monitoring networks for groundwater levels and groundwater quality have not been evaluated in all basins to ensure that the data accurately represent conditions in the aquifer(s).**
  - Groundwater levels are monitored in about 10,000 active wells including those basins where most of the groundwater is used.
  - Groundwater levels are not monitored in approximately 200 basins, where population is sparse and groundwater use is generally low.
  - Groundwater quality monitoring networks are most dense near population centers and may not be representative of the basin as a whole.
  - Many of the wells being monitored are not ideally constructed to provide water level or water quality information that is representative of a specific aquifer.
  - Many wells are too deep to monitor changes in the unconfined (water table) portion of basins.
15. **The coordination of groundwater data collection and evaluation by local, State, and federal agencies is improving.**
  - The State Water Resources Control Board (SWRCB) recently formed the Groundwater Resources Information Sharing Team (GRIST) consisting of several State and federal agencies with groundwater-related programs.
  - DWR established a website in 1996 that has provided water-level data and hydrographs for more than 35,000 active and inactive wells monitored by DWR and cooperating agencies.
  - DWR collects and maintains water level data in part through partnerships with local agency cooperators.
  - DWR staff collaborated with many local, State, and federal agencies in developing this update of Bulletin 118.
  - SWRCB recently formed an interagency task force to develop a comprehensive groundwater quality monitoring program for assessing every groundwater basin in the State as required by the Groundwater Quality Monitoring Act of 2001 (AB 599; Water Code, § 10780 et seq.).
  - Water purveyors have concerns about balancing public access to data with water supply security.

16. **Boundaries of groundwater basins have been determined using the best available geologic and hydrologic information. These boundaries are important in determining the availability of local water supplies.**
  - Basin boundaries were derived primarily by identifying alluvial sediments on geologic maps using the best available information, but are subject to change when new information becomes available.
  - The Water Code requires the use of basin boundaries defined in Bulletin 118 in groundwater management plans and urban water management plans.
  - The location of basin boundaries will become more critical as the demand for water continues to increase.
  - Subbasin boundaries may be delineated for management convenience rather than based on hydrogeologic conditions.
17. **Little is known about the stream-aquifer interaction in many groundwater basins.**
  - Groundwater and surface water are closely linked in the hydrologic cycle.
  - The relationship between streamflow and extraction of groundwater is not fully understood in most basins and is generally not monitored.
  - Groundwater extraction in many basins may affect streamflow.
  - Interaction of groundwater flow and surface water may affect environmental resources in the hyporheic zone.
  - An understanding of stream-aquifer interaction will be essential to evaluating water transfers in many areas of the State.
18. **Although many new wells are built in fractured rock areas, insufficient hydrogeologic information is available to ensure the reliability of groundwater supplies.**
  - Population is increasing rapidly in foothill and mountain areas in which groundwater occurs in fractured rock.
  - The cumulative effect of groundwater development may reduce the yield of individual wells, lower the flow of mountain streams, and impact local habitat.
  - Characterization of groundwater resources in fractured rock areas can be very expensive and complex.
  - Many groundwater users in these areas have no other water supply alternatives.
  - Recent dry years have seen many wells go dry in fractured rock areas throughout the State.
  - Groundwater management in these areas is beginning, but there is insufficient data to support quantitative conclusions about the long-term sustainable yield.
19. **When new wells are built, drillers are required to file a Well Completion Report with DWR. That report contains a lithologic log, the usability of which varies considerably from driller to driller.**
  - The Well Completion Reports are confidential and not available to the public, as stipulated by the Water Code, unless the owner's permission is obtained.
  - The usefulness of the information in Well Completion Reports varies but is not fully realized.
  - Public access to Well Completion Reports would increase understanding of groundwater conditions and issues.
  - There is no provision in the Water Code that requires submission of geophysical logs, which would provide an accurate log of the geologic materials within the aquifer.
  - Geophysical logs would provide a greatly improved database for characterization of aquifers.



## Recommendations

## Major Recommendations

1. **Local or regional agencies should develop groundwater management plans if groundwater constitutes part of their water supply. Management objectives should be developed to maintain a sustainable long-term supply for multiple beneficial uses. Management should integrate water quantity and quality, groundwater and surface water, and recharge area protection.**
  - Groundwater management in California is a local agency responsibility.
  - In basins where there is more than one management agency, those agencies should coordinate their management objectives and program activities.
  - A water budget should be completed that includes recharge, extraction and change in storage in the aquifer(s).
  - Changes in groundwater quality should be monitored and evaluated.
  - Stakeholders should be identified and included in development of groundwater management plans.
2. **The State of California should continue programs to provide technical and financial assistance to local agencies to develop monitoring programs, management plans, and groundwater storage projects to more efficiently use groundwater resources and provide a sustainable supply for multiple beneficial uses. DWR should:**
  - Post information about projects that have successfully obtained funding through various grant and loan programs.
  - Provide additional technical assistance to local agencies in the preparation of grant and loan applications.
  - Continue outreach efforts to inform the public and water managers of grant and loan opportunities.
  - Participate, when requested, in local efforts to develop and implement groundwater management plans.
  - Continue to assess, develop, and modify its groundwater programs to provide the greatest benefit to local agencies.
  - Develop grant criteria to ensure funding supports local benefits as well as Statewide priorities, such as development of the California Water Plan and meeting Bay-Delta objectives.
3. **DWR should continue to work with local agencies to more accurately define historical overdraft and to more accurately predict future water shortages that could result in overdraft.**
  - A water budget should be developed for each basin.
  - The annual change in storage should be determined for each basin.
  - The amount of annual recharge and discharge, including pumping, should be determined.
  - Changes in groundwater quality that make groundwater unusable or could allow additional groundwater to be used should be included in any evaluation of overdraft.
4. **Groundwater management agencies should work with land use agencies to inform them of the potential impacts various land use decisions may have on groundwater, and to identify, prioritize, and protect recharge areas.**
  - Local planners should consider recharge areas when making land use decisions that could reduce recharge or pose a risk to groundwater quality.
  - Recharge areas should be identified and protected from land uses that limit recharge rates, such as paving or lining of channels.



- Both local water agencies and local governments should pursue education and outreach to inform the public of the location and importance of recharge areas.
  - DWR should inform local agencies of the availability of grant funding and technical assistance that could support these efforts.
5. **DWR should publish a report by December 31, 2004 that identifies those groundwater basins or subbasins that are being managed by local or regional agencies and those that are not, and should identify how local agencies are using groundwater resources and protecting groundwater quality.**
    - Such information will be necessary to confirm whether agencies are meeting the requirements of SB 1938 (Water Code Section 10753.7).
    - Collection and summary of existing groundwater management plans will provide a better understanding of the distribution and coordination of groundwater management programs throughout the State.
    - Successful strategies employed by specific local agencies should be highlighted to assist others in groundwater management efforts.
    - Similarly, the impact of groundwater management ordinances throughout the State should be evaluated to provide a better understanding of the effect of ordinances on groundwater management.
  6. **Water managers should include an evaluation of water quality in a groundwater management plan, recognizing that water quantity and water quality are inseparable.**
    - Local water managers should obtain groundwater quality data from federal, state, and local agencies that have collected such data in their basin.
    - Local agencies should evaluate long-term trends in groundwater quality.
    - Local agencies should work closely with the SWRCB and DWR in evaluating their groundwater basins.
    - Local agencies should establish management objectives and monitoring programs that will maintain a sustainable supply of good quality groundwater.
  7. **Water transfers that involve groundwater (or surface water that will be replaced with groundwater) should be consistent with groundwater management in the source area that will assure the long term sustainability of the groundwater resource.**
  8. **Continue to support coordinated management of groundwater and surface water supplies and integrated management of groundwater quality and groundwater quantity.**
    - Future bond funding should be provided for conjunctive use facilities to improve water supply reliability.
    - Funding for feasibility and pilot studies, in addition to construction of projects will help maximize the potential for conjunctive use.
    - DWR should continue and expand its efforts to form partnerships with local agencies to investigate and develop locally controlled conjunctive use programs.
  9. **Local, State, and federal agencies should improve data collection and analysis to better estimate groundwater basin conditions used in Statewide and local water supply reliability planning. DWR should:**
    - Assist local agencies in the implementation of SB 221, SB 610, and AB 901 to help determine water supply reliability during the local land use planning process.
    - Provide and continue to update information on groundwater basins, including basin boundaries, groundwater levels, monitoring data, aquifer yield, and other aquifer characteristics.

- Identify areas of rapid development that are heavily reliant on groundwater and prioritize monitoring activities in these areas to identify potential impacts on these basins.
  - Evaluate the existing network of wells monitored for groundwater elevations, eliminate wells of questionable value from the network, and add wells where data are needed.
  - Work cooperatively with local groundwater managers to evaluate the groundwater basins of the State with respect to overdraft and its potential impacts, beginning with the most heavily used basins.
  - Expand DWR and local agency monitoring programs to provide a better understanding of the interaction between groundwater and surface water.
  - Work with SWRCB to investigate temporal trends in water quality to identify areas of water quality degradation that should receive additional attention.
  - Estimate groundwater extraction using a land use based method for over 200 basins with little or no groundwater budget information.
  - Integrate groundwater budgets into the California Water Plan Update process.
10. **Increase coordination and sharing of groundwater data among local, State, and federal agencies and improve data dissemination to the public. DWR should:**
- Use the established website to continually update new groundwater basin data collected after the publication of California's Groundwater (Bulletin 118-Update 2003).
  - Publish a summary update of Bulletin 118 every five years coincident with the California Water Plan (Bulletin 160).
  - Publish, in cooperation with SWRCB, a biennial groundwater report that addresses current groundwater quantity and quality conditions.
  - Coordinate the collection and storage of its groundwater quality monitoring data with programs of SWRCB and other agencies to ensure maximum coverage statewide and reduce duplication of effort.
  - Make groundwater basin information more compatible with other Geographic Information System-based resource data to improve local integrated resources planning efforts.
  - Compile data collected by projects funded under grant and loan programs and make data available to the public on the DWR website.
  - Encourage local agency cooperators to submit data to the DWR database.
  - Maximize the accuracy and usefulness of data and develop guidelines for quality assurance and quality control, consistency, and format compatibility.
  - Expand accessibility of groundwater data by the public after considering appropriate security measures.
  - State, federal and local agencies should expand accessibility of groundwater data by the public after considering appropriate security measures.
  - Local agencies should submit copies of adopted groundwater management plans to DWR.

### **Additional Important Recommendations**

11. **Local water agencies and local governments should be encouraged to develop cooperative working relationships at basinwide or regional levels to effectively manage groundwater. DWR should:**
- Provide technical and financial assistance to local agencies in the development of basinwide groundwater management plans.
  - Provide a preference in grant funding for groundwater projects for agencies that are part of a regional or basinwide planning effort.
  - Provide Proposition 50 funding preferences for projects that are part of an integrated regional water management plan.

12. **Groundwater basin boundaries identified in Bulletin 118 should be updated as new information becomes available and the basin becomes better defined. DWR should:**
  - Identify basin boundaries that are based on limited data.
  - List the kind of information that is necessary to better define basin boundaries.
  - Develop a systematic procedure to obtain and evaluate stakeholder input on groundwater basin boundaries.
13. **Improve the understanding of groundwater resources in fractured rock areas of the State.**
  - DWR, in cooperation with local and federal agencies, should conduct studies to determine the amount of groundwater that is available in fractured rock areas, including water quality assessment, identification of recharge areas and amounts, and a water budget when feasible.
  - Local agencies and local governments should conduct studies in their areas to quantify the local demands on groundwater and project future demands.
  - The Legislature should consider expanding the groundwater management authority in the Water Code to include areas outside of alluvial groundwater basins
  - DWR should include information on the most significant fractured rock groundwater sources in future updates of Bulletin 118.
14. **Develop a program to obtain geophysical logs in areas where additional data are needed.**
  - DWR should encourage submission of geophysical logs, when they are conducted, as a part of the Well Completion Report.
  - The geophysical logs would be available for use by public agencies to better understand the aquifer, but would be confidential as stipulated by the Water Code.
  - DWR should seek funding to work with agencies and property owners to obtain geophysical logs of new wells in areas where additional data are needed.
  - Geophysical logs would be used to better characterize the aquifers within each groundwater basin.
15. **Educate the public on the significance of groundwater resources and on methods of groundwater management.**
  - DWR should continue to educate the public on statewide groundwater issues and assist local agencies in their public education efforts.
  - Local agencies should expand their outreach efforts during development of groundwater management plans under AB 3030 and other authority.
  - DWR should develop educational materials to explain how they quantify groundwater throughout the State, as well as the utility and limitations of the information.
  - DWR should continue its efforts to educate individual well owners and small water systems that are entirely dependent on groundwater.

